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	DB=USPT; PLUR=YES; OP=ADJ		
L13	L12 and ion exchange same resin	74	L13
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L8	210/636.ccls.	358	L8
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=ADJ		
L7	immersed and membrane and ion exchange	5704	L7
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L6	US-20050035041-A1.did.	1	L6
L5	US-20050035041-A1.did.	1	L5
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	DB=JPAB; PLUR=YES; OP=ADJ		
L3	L2 and resin and ion exchange	0	L3
L2	microfiltration and immersed	4	L2

L1	immersed membrane and ion exchage and resin	0	L1

END OF SEARCH HISTORY

NAME	CITY	STATE	ZIP CODE	COUNTRY
Arnal; Kevin R.	Chanhassen	MN		
Andrus; Robert G.	Plymouth	MN		
Luhring; David A.	Savage	MN		
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US-CL-CURRENT: 134/167R; 134/177, 134/186, 210/321.69, 210/636, 210/646

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

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8. Document ID: US 5928516 A

L9: Entry 8 of 13 File: USPT Jul 27, 1999

US-PAT-NO: 5928516
DOCUMENT-IDENTIFIER: US 5928516 A

TITLE: Filter package

DATE-ISSUED: July 27, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
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US-CL-CURRENT: 210/636; 210/232, 210/257.2, 210/416.3, 422/21, 422/25, 422/26, 53/425

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

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9. Document ID: US 5403479 A

L9: Entry 9 of 13 File: USPT Apr 4, 1995

US-PAT-NO: 5403479
DOCUMENT-IDENTIFIER: US 5403479 A

TITLE: In situ cleaning system for fouled membranes

DATE-ISSUED: April 4, 1995

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Smith; Bradley M.	Hamilton			CA
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US-CL-CURRENT: 210/321.69; 210/195.2, 210/257.2, 210/321.8, 210/321.89, 210/636

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

10. Document ID: US 4888116 A

L9: Entry 10 of 13 File: USPT Dec 19, 1989

US-PAT-NO: 4888116
DOCUMENT-IDENTIFIER: US 4888116 A

TITLE: Method of improving membrane properties via reaction of diazonium compounds or precursors

DATE-ISSUED: December 19, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
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US-CL-CURRENT: 210/636; 210/500.38, 210/654, 210/655

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

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L13: Entry 25 of 74 File: USPT Aug 31, 1999

DOCUMENT-IDENTIFIER: US 5944998 A
TITLE: Rotary filtration device with flow-through inner member

Detailed Description Text (43):
High solids content fluids may be, for example, biological fluids, fluids containing affinity particles (e.g., selective sorption affinity particles), particles of ion exchange resin, catalyst particles, adsorbent particles, absorbent particles, and particles of inert carrier. The inert carrier particles may themselves carry catalyst, resin, reactants, treating agents (e.g., activated charcoal), etc.

Detailed Description Text (88):
In FIG. 4, the distal end (in this case, the lower end) of shaft 50 extends almost to the bottom of inner member 36, and part of rotatable bearing 116 (e.g., in this case, the pin) is connected to the bottom of the shaft. Impeller 54 is located near the bottom of the shaft. A significant advantage of having the impeller located as near as possible to the bottom of the reservoir of feed fluid is that a greater proportion of the feed fluid will be able to be processed by the device. That is because rotation of the impeller can keep internal pathway 46 and fluid filtration gap 48 filled with fluid as long as impeller 54 remains submerged in feed fluid. Thus, the device will be able to process as much of the feed fluid as possible while keeping the fluid filtration gap filled and the membrane wet even if the level of feed fluid drops lower and lower in the reservoir of feed fluid. Also, if there is any circumstance, e.g., a process interruption such as a power loss, that allows the feed fluid level to drop below the most distal of the motive means (e.g., an impeller), it will be impossible to resume processing without some sort of intervention (e.g., external priming of the system) because the motive means will not be able to cause the fluid to flow through the internal pathway and fluid filtration gap. As indicated above, the distal impeller may be located 2 centimeters or less from the bottom of the reservoir of feed fluid or the distal impeller may be located 30 centimeters or more from the bottom of the reservoir of feed fluid or at any place in between.

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L13: Entry 30 of 74 File: USPT Jun 30, 1998

DOCUMENT-IDENTIFIER: US 5772891 A
TITLE: Water treating method for treating waste water by using ion exchange resin

Abstract Text (1):
A water treating apparatus is provided which can treat waste water for use as raw water in an ultrapure water producing system without addition of various kinds of chemicals. The apparatus includes a first water tank for receiving acid waste water, a second water tank for subjecting the waste water from the first water tank to solid-liquid separation and discharging supernatant liquid, an ion exchange tank including ion exchange resin and an aeration tube for generating treated water through a membrane filter, a precipitation tank for settling ion exchange resin, an air lift pump for introducing ion exchange resin from the precipitation tank into the first water tank, and a return air lift pump for returning ion exchange resin from the second water tank to the ion exchange tank. The ion exchange resin acts to exchange ions with fluorine ions of treated water in the ion exchange tank and is regenerated by acid waste water in the first water tank.

Brief Summary Text (3):
The present invention relates to a method and apparatus for water treatment and, more particularly, to a water treating method and apparatus which make it possible to utilize used ion exchange resin by regenerating the same with acid waste water or alkali waste water from a semiconductor plant, and which enables effective use of resources.

Brief Summary Text (6):
Hitherto, used ion exchange resins from most ultrapure water production systems have not been recycled but simply discarded as industrial waste.

Brief Summary Text (10):
Further, when the treated water is supplied to the ultrapure water production system, the coagulants adhere to the surface of ion exchange resin to deteriorate its ability, or clog a reverse osmosis (RO) membrane, because the treated water contains the coagulants. As a result, the treated water cannot be recycled.

Brief Summary Text (17):
A few semiconductor plants exist in Japan which are equipped with a complete closed system capable of recycling acid waste water. In plant facilities with such a complete closed system, it is common practice that after dilute acid waste water is passed through an activated carbon filter for treatment of organic matter and/or hydrogen peroxide, the waste water is passed through weak anion exchange resin and cation exchange resin and is further subjected to UV (ultraviolet) germicidal and other treatments for microorganism disinfection.

Brief Summary Text (18):
Another water treating method in which acid waste water can be reused is described in Japanese Patent Laid-Open Publication No. 63-62592. This method is such that after waste water is passed through an activated carbon filter, the waste water is treated in a mixed bed tower of strong acid cation exchange resin and weak basic anion exchange resin. Through this treatment the waste water is converted into ultrapure water for reutilization.

Brief Summary Text (19):
In both of aforesaid two water treating methods are used ion exchange resins. The methods, therefore, have a disadvantage that the ion exchange resin require regeneration and, when the ion exchange resin is deteriorated in its performance, it must be replaced and discarded.

Brief Summary Text (22):
Referring now to FIG. 5, operation of a cation exchange resin tower 125 as an example of an ion exchange apparatus of the type which is employed in aforesaid two water treating methods will be explained. The cation exchange resin tower 125 is loaded with a predetermined amount of cation exchange resin. The water to be treated is allowed to flow a given amount at a time through a top inlet 125A of the cation exchange resin tower 125. In case that the electric conductivity of treated water as discharged from an outlet 125C of the cation exchange resin tower 125 should become unfavorable, several % hydrochloric acid or sulfuric acid is fed through a lower inlet 125B into the cation exchange resin tower 125 to regenerate the cation exchange resin. After regeneration of the cation rein, the regenerating waste water (hydrochloric acid or sulfuric acid) used is discharged from an outlet piping 125D at the top of the cation exchange resin tower 125.

Brief Summary Text (23):
Generally, the cation exchange resin tower 125 which constitutes an ultrapure water production apparatus does not directly receive industrial water or city water but allows such water to flow into the tower 125 only after the water is subjected to pretreatment in a pretreating apparatus H1 as shown in FIG. 5. For such pretreatment, methods such as coagulating sedimentation, coagulating filtration, activated carbon adsorption, and reverse osmosis membrane treatment may be employed alone or in combination.

Brief Summary Text (24):
In this way, pretreated water generated by causing industrial water or city water to undergo quality improving treatment is introduced into the cation exchange resin tower 125 or ultrapure water production apparatus. Therefore, the cation exchange resin tower 125 is employed in a comparatively favorable water quality condition. In other words, water of comparatively good quality or water pretreated to such quality level is supplied into the cation exchange resin tower 125. Therefore, usual practice has been that immediately when the quality of water discharged from the outlet of the cation exchange resin tower 125 becomes unfavorable, the cation exchange resin is regenerated, or if regeneration does not result in water quality improvement, the cation exchange resin is judged to be unsuitable for use with the ultrapure water production apparatus and is totally replaced at a cost involved for the purpose.

Brief Summary Text (25):
With no exception, semiconductor plants are equipped with a large scale ion exchange resin unit as shown in FIG. 5. The ultrapure water production unit has a large amount of cation exchange resin placed therein. When the ion exchange performance of the cation exchange resin itself is deteriorated, the resin is usually disposed of as industrial waste irrespective of costs involved therefor. The reason is that if the cation exchange resin is deteriorated in performance, not only does water yield decrease, but there occurs the problem of organic matter eluation from the cation exchange resin. However, this does not mean that the resin has totally lost its ion exchange capability, but means that the resin has been deteriorated in its ion exchange performance.

Brief Summary Text (26):
Even then, however, it has been usual practice that cation exchange resin, when its performance is deteriorated, is not reutilized, but discarded as industrial waste at the expense of necessary disposal cost. Used ion exchange resin as industrial

waste has in no case been reutilized in any recycling unit which is of lower level than aforesaid ultrapure water production unit in terms of water quality.

Brief Summary Text (28):
At present, several semiconductor plants exist which employ a complete closed system. However, the truth is that while only dilute acid waste water is recycled by treating such waste water by ion exchange resin or the like, such an acid waste water mixture that dilute acid waste water and strong acid waste water are mixed together is in no case recycled.

Brief Summary Text (29):
Further, there has been no practice of recycling quality-deteriorated ion exchange resin that is discarded as industrial waste from an ultrapure water production unit.

Brief Summary Text (30):
Where ion exchange resin is used in the cation exchange resin tower 125, used ion exchange resin must be chemically regenerated. With one resin tower 125 alone, therefore, it is not possible to carry out continuous operation. Further, for the purpose of regenerating ion exchange resin, a particular chemical (regeneration liquor) is separately needed. In this conjunction, it is also necessary to carry out neutralization treatment after the ion exchange resin is passed through the regeneration liquor. This poses the problem of running cost for neutralization treatment.

Brief Summary Text (33):
It is another object of the invention to provide a waste water treating method and apparatus which make it possible to effectively recycle used ion exchange resins which have conventionally been discarded as industrial waste.

Brief Summary Text (36):
introducing anionic water or cationic water into an ion exchange tank for subjecting the anionic water or cationic water to an ion exchange treatment with anion exchange resin or cation exchange resin to thereby obtain treated water;

Brief Summary Text (37):
introducing the anion exchange resin or cation exchange resin in the ion exchange tank into the first water tank to regenerate the anion exchange resin or cation exchange resin with the alkali water or acid water; and

Brief Summary Text (38):
returning the anion exchange resin or cation exchange resin regenerated in the first water tank to the ion exchange tank;

Brief Summary Text (39):
said anion exchange resin or cation exchange resin being circulated between the ion exchange tank and the first water tank.

Brief Summary Text (40):
Therefore, according to the present invention, the anionic water or cationic water introduced into the ion exchange tank is subjected to ion exchange with the anion exchange resin or cation exchange resin in the ion exchange tank. After this ion exchange treatment, the anion exchange resin or cation exchange resin, that is, ion exchange resin is introduced into the first water tank. The anion exchange resin or cation exchange resin introduced into the first water tank is regenerated with alkali water or acid water in the first water tank. The regenerated anion exchange resin or cation exchange resin is returned to the ion exchange tank.

Brief Summary Text (41):
In this way, according to the invention, the ion exchange resin used for ion

exchange in the ion exchange tank is regenerated by the alkali water or acid water in the first water tank. Further, in this regeneration process, the alkali water or acid water is brought close to neutrality by virtue of the ion exchange resin. In other words, according to the invention, by repeating the process of using the ion exchange resin in the ion exchange tank and regenerating used ion exchange resin in the first water tank, it is possible to use the ion exchange resin advantageously for water treating purposes in both the first water tank and the ion exchange tank. Therefore, the invention permits most effective use of ion exchange resins for water treatment. Further, used ion exchange resins need not be discarded as waste, and this results in good saving in the cost of waste disposal. Thus, the invention provides a water treating method which involves less waste, permits effective resource utilization, and requires less running cost.

Brief Summary Text (42):
According to the invention, treated water is obtained through ion exchange treatment of waste water with ion exchange resin in the ion exchange tank. The treated water from the ion exchange tank has a substantially lower electric conductivity because of the ion exchange effected in that tank, and can be used as raw water for supply to an ultrapure water production system. This results in effective utilization of water.

Brief Summary Text (43):
According to an embodiment of the invention, the alkali water or acid water introduced into the first water tank is an alkali waste water or acid waste water to be treated, and the alkali waste water or acid waste water which has been subjected to a predetermined treatment after regenerating the anion exchange resin or cation exchange resin in the first water tank is introduced into the ion exchange tank as water to be treated.

Brief Summary Text (44):
According to this embodiment, the alkali waste water or acid waste water in the first water tank can be effectively utilized for regeneration of the ion exchange resin and, at the same time, can be brought close to neutrality through utilization of the ion exchange resin. This means that regeneration and treatment can be simultaneously carried out in one stage, which in turn means efficient water treatment.

Brief Summary Text (48):
an ion exchange tank having anion exchange resin or cation exchange resin into which anionic water or cationic water is introduced such that the anionic water or cationic water is subjected to an ion exchange treatment with the anion exchange resin or cation exchange resin for generation of treated water;

Brief Summary Text (49):
an ion exchange resin introduction means for introducing into the first water tank the anion exchange resin or cation exchange resin in the ion exchange tank;

Brief Summary Text (50):
an ion exchange resin return means for returning to the ion exchange tank the anion exchange resin or cation exchange resin regenerated by alkali water or acid water in the first water tank; and

Brief Summary Text (51):
means for receiving alkali water or acid water from the first water tank in which the anion exchange resin or cation exchange resin has been regenerated and for introducing into the ion exchange tank water to be treated which is the alkali water or acid water having been subjected to a predetermined treatment.

Brief Summary Text (52):
According to this embodiment, the anionic water or cationic water introduced into

the ion exchange tank is subjected to ion exchange with anion exchange resin or cation exchange resin in the ion exchange tank. After this ion exchange treatment, the ion exchange resin is introduced into the first water tank by the ion exchange resin introduction means. The anion exchange resin or cation exchange resin introduced into the first water tank is regenerated with the alkali waste water or acid waste water in the first water tank. The regenerated anion exchange resin or cation exchange resin is returned to the ion exchange tank through the ion exchange resin return means.

Brief Summary Text (53):
In this way, according to this embodiment, the ion exchange resin used for ion exchange in the ion exchange tank is regenerated with alkali water or acid water in the first water tank. Further, in this regeneration process, the alkali water or acid water is brought close to neutrality by the action of the ion exchange resin. In other words, by repeating the process of using the ion exchange resin in the ion exchange tank and regenerating used ion exchange resin in the first water tank, it is possible to use the ion exchange resin advantageously for water treating purposes in both the first water tank and the ion exchange tank. Therefore, the embodiment permits most effective use of ion exchange resins for water treatment. Further, used ion exchange resins need not be discarded as waste, and this results in good saving in the cost of waste disposal. Thus, the embodiment provides a water treating apparatus which enables reduced waste generation, permits effective resource utilization, and requires less running cost.

Brief Summary Text (54):
According to the embodiment, treated water is obtained through ion exchange treatment of waste water with ion exchange resin in the ion exchange tank. The treated water from the ion exchange tank has a substantially lower electric conductivity because of the ion exchange effected in that tank, and can be used as raw water for supply to an ultrapure water production system. This results in effective utilization of water.

Brief Summary Text (55):
In the apparatus of the embodiment, after regeneration of used ion exchange resin in the first tank, the alkali water or acid water undergoes a predetermined treatment, and the resulting treated water is introduced into the ion exchange tank for ion exchange. This enables supply of a treated water suitable for use as raw water in an ultrapure water production system. Thus, according to the embodiment, after the alkali water or acid water is subjected to a predetermined treatment, the water is caused to undergo the process of ion exchange, whereby the water can be turned into raw water for use with the ultrapure water production system. This provides for improvement in waste water recycling efficiency.

Brief Summary Text (57):
According to the embodiment, it is possible to carry out the step of regenerating the ion exchange resin in the first water tank and the step of bringing the alkali waste water or acid waste water to a neutral water level in one treating operation, which results in improved water treating efficiency.

Brief Summary Text (58):
A water treating apparatus of an embodiment comprises aeration means for mixing the alkali water or acid water with anion exchange resin or cation exchange resin in the first water tank.

Brief Summary Text (59):
According to this embodiment, it is possible to mix the ion exchange resin with the alkali water or acid water without damaging the ion exchange resin, thereby to facilitate regeneration of the ion exchange resin.

Brief Summary Text (60):

A water treating apparatus of an embodiment comprises aeration means for mixing the anionic water or cationic water with anion exchange resin or cation exchange resin in the ion exchange tank.

Brief Summary Text (61):
According to this embodiment, it is possible to mix the ion exchange resin with anionic water or cationic water without causing any damage and/or wear to the ion exchange resin, thereby to facilitate ion exchange treatment of the anionic water or cationic water with the ion exchange resin.

Brief Summary Text (62):
According to an embodiment, the ion exchange resin introduction means and the ion exchange resin return means each comprise piping interconnecting the first water tank and the ion exchange tank and an air lift pump.

Brief Summary Text (63):
According to this embodiment, it is possible to enable the ion exchange resin to be efficiently transported from the ion exchange tank to the first water tank or from the first water tank to the ion exchange tank without causing any damage and/or wear to the ion exchange resin.

Brief Summary Text (64):
According to an embodiment, the ion exchange tank includes a membrane filter placed therein and there is provided a treated water discharge means for discharging a treated water from which the anion exchange resin or cation exchange resin has been separated through the membrane filter.

Brief Summary Text (65):
According to the embodiment, the treated water from which the ion exchange resin has been separated by the treated water discharge means can be used for supply as raw water to the ultrapure water production system.

Brief Summary Text (66):
According to an embodiment, the means for introducing into the ion exchange tank the water to be treated which has been subjected to the predetermined treatment include a calcium carbonate mineral tank having a calcium carbonate mineral placed therein which receives from the first water tank an acid waste water having regenerated the cation exchange resin in the first water tank and which discharges a liquid resulting from the calcium carbonate mineral dissolved in the acid waste water to have a liquid level close to neutrality.

Brief Summary Text (67):
According to this embodiment, when the acid waste water is treated with the calcium carbonate mineral, calcium ions elute into the acid water of low pH value so that the treated water contains calcium ions. The calcium ions contained in the treated water are attached to the cation exchange resin in the ion exchange tank. That is, the cation exchange resin acts to remove calcium ions from the treated water on an interchange mode. Used cation exchange resin which has been brought into bond with the calcium ions is introduced into the first water tank for regeneration therein.

Brief Summary Text (68):
In this way, according to the embodiment, the treated water obtained after the acid waste water is treated with the calcium carbonate mineral is cationic water that is to be introduced into the ion exchange tank. Therefore, according to the embodiment, the acid waste water will first react with the cation exchange resin in the first water tank to regenerate the cation exchange resin. In this case, the pH of the acid waste water is increased so that the pH is brought close to a neutral water level. Then, the acid waste water brought close to neutrality reacts with the calcium carbonate mineral so that the water gets closer to neutrality. As the pH value further increases, the acid waste water that contains calcium ions is

rendered electrically less conductive in the ion exchange tank in which the calcium ions are removed. Thus, treated water that is usable as raw water for the ultrapure water production system can be obtained.

Drawing Description Text (7):
FIG. 5 is a schematic diagram showing a conventional cation resin tower.

Detailed Description Text (4):
FIG. 1 shows a first embodiment of a water treating apparatus in accordance with the invention. In the first embodiment, the water treating apparatus comprises a first water tank 1, a second water tank 2, a third water tank 3, a fourth water tank 4, a fifth water tank 5, an ion exchange resin unit 26, and a reverse osmosis (RO) membrane unit 27.

Detailed Description Text (5):
The first water tank 1 has an aeration tube 8 as agitation means and receives alkali waste water (i.e. water containing regenerating chemicals) from a semiconductor plant. The aeration tube 8 is connected to a blower 10. An incoming air lift pump 15 is fixedly mounted at the top end of the first water tank 1. The first water tank 1 has a function of an anion exchange resin recycling/aeration tank as will be described hereinafter.

Detailed Description Text (9):
The third water tank 3 has an aeration tube 16 and is fed with anionic waste water which contains F.sup.- and SO.sub.4.sup.2- as negative ions. The aeration tube 16 is connected to a blower 23. The third water tank 3 is fed with anion exchange resin 21 as ion exchange resin. The third water tank 3 is equipped with a membrane filter unit 17. The membrane filter unit 17 includes a plurality of laterally arranged ultrafilter membranes and/or precision filter membranes. Treated water that has passed through the membrane filter unit 17 is pumped up by a pump 20 and introduced into the fifth water tank 5.

Detailed Description Text (10):
Anionic waste water from the third water tank 3 that contains anion exchange resin 21 is introduced into the fourth water tank 4 through an outlet pipe (not shown) of a partition wall W. An aeration tube 22 which functions as air introduction means is disposed within the lower end portion 15B of the incoming air lift pump 15 which is open at the lowermost end 4A-1 of the fourth water tank 4. The aeration tube 22 is connected to the blower 23.

Detailed Description Text (11):
The treated water introduced from the third water tank 3 into the fifth water tank 5 is pumped up by a pump 24 into the ion exchange resin unit 26, and further into the reverse osmosis membrane unit 27. The ion exchange resin unit 26, in combination with the reverse osmosis membrane unit 27, constitutes a primary pure water production system 28.

Detailed Description Text (12):
In the water treating apparatus of the above described setup, alkali waste water is first introduced into the first water tank 1 which functions as an anionic resin recycling/aeration tank. The alkali waste water acts to regenerate the anionic resin introduced by the incoming air lift pump 15 into the first water tank 1. In other words, the alkali waste water expels the negative ions exchanged by the anion exchange resin 21 to restore the ion exchangeability of the anion exchange resin 21. The anion exchange resin 21 in the first water tank 1 which has thus restored its ion exchangeability is introduced into an adjacent tank, i. e., the second water tank (a first sedimentation tank) 2, in which the anion exchange resin 21 goes down and further moves downward along the inclined bottom 2A until it reaches the lowermost portion 2A-1. Particles of anion exchange resin 21 which have reached the lowermost portion 2A-1 are sucked through the inlet end 12A of the return air

lift pump 12 for being moved upward together with air 30. The air 30 is discharged from the top open end 12B. Particles of the anion exchange resin 21 move downward along the lateral extension 12C and further continue to travel downward for return into the third water tank 3 from above. The anion exchange resin 21 thus sent back to the third water tank 3 acts to remove negative ions (F.sup.- and/or SO.sub.4.sup.2-) on an exchange basis from the anionic waste water which is under agitation by the aeration tube 16. The anionic waste water which has thus been made free from negative ions is passed through a membrane filter 19 and pumped up by a pump 20 for being introduced into the fifth water tank 5.

Detailed Description Text (13):
Particles of the used anion exchange resin 21 which are fed through the effluent pipe (not shown) of partition wall W of the third water tank 3 into the adjacent fourth water tank 4 are allowed to move downward along the inclined bottom 4A until they reach the lowermost end 4A-1. Then, the anion exchange resin 21 particles are sucked through the lower end portion 15B of the incoming air lift pump 15, being caused to move upward with air 30. The air 30 is discharged from the open end 15A. Particles of anion exchange resin 21 move leftward along a downward slope of the incoming air lift pump 15 and descend vertically from a location above the first water tank 1 until they reach the tank 1. Particles of anion exchange resin 21 which have reached the first water tank 1 are regenerated by alkaline waste water as earlier stated.

Detailed Description Text (14):
The anionic waste water which is introduced into the fifth water tank 5 is then supplied as water under treatment to the ion exchange resin unit 26 of the ultrapure water production system 28 and is subjected to further ion exchange treatment. The treated water is passed through the reverse osmosis membrane unit 27 and is then collected as primary pure water.

Detailed Description Text (15):
In this way, according to this first embodiment, F.sup.- and/or SO.sub.4.sup.2- is removed from the anionic waste water by anion exchange resin 21 in the third water tank 3, and the used anion exchange resin 21 is introduced into the first water tank 1 by means of the air lift pump 15 so that the anion exchange resin 21 is regenerated with alkali waste water. The anion exchange resin 21 thus regenerated is returned by the return air lift pump 12 to the third water tank 3. In this first embodiment, therefore, the operation in the first water tank 1 for neutralization of the alkali waste water from the semiconductor plant also serves the purpose of regenerating the anion exchange resin 21. In other words, the arrangement makes it possible to simultaneously carry out the treatment of the alkali waste water and the regeneration of the anion exchange resin 21. According to the arrangement, therefore, it is possible to utilize a waste water mixture of strong alkali waste water and dilute alkali waste water as raw water for an ultrapure water production system 28 without addition of various kinds of chemicals.

Detailed Description Text (16):
Further, according to this first embodiment, the ion exchange resin already used in the ion exchange resin unit 26 is introduced into the third water tank 3 for reuse therein, and this provides for quantity reduction of industrial waste and, in addition, cost reduction in waste treatment.

Detailed Description Text (17):
In the first water tank 1, regeneration of the anion exchange resin 21 may result in that the waste water therein may contain anions from the anion exchange resin 21, but this involves no problem because the resulting anion concentration is low and because such anion content is removed in the subsequent process of waste water treatment. In this first embodiment, regeneration of anion exchange resin 21 is carried out with alkaline waste water, but it is needless to say that cation exchange resin regeneration may be carried out with acid waste water. This first

embodiment takes advantage of the fact that acid waste water and/or alkali waste water from semiconductor plants has no much impurity content other than acid and alkali substances.

Detailed Description Text (20):
As FIG. 2 shows, the apparatus of this second embodiment includes a first water tank 41, a second water tank 42, a third water tank 43, a fourth water tank 44, a fifth water tank 45, a sixth water tank 46, a seventh water tank 47, an eighth water tank 48, a ninth water tank 49, a tenth water tank 50, and an eleventh water tank 51. The apparatus also includes a concentration tank 52 and a filter press 53. Further, the apparatus includes a primary pure water production unit 56 having an ion exchange resin unit 54 and a reverse osmosis membrane unit 55.

Detailed Description Text (27):
The ninth water tank 49 is disposed adjacent to the eighth water tank 48 in spaced relation thereto. The ninth water tank 49 has an aeration tube 88 at the bottom thereof. The aeration tube 88 is connected to a fifth blower 90. The ninth water tank 49 has a membrane filter portion 91 in a top portion thereof. The membrane filter portion 91 has a plurality of laterally arranged ultrafilter membranes or precision filter membranes. In the present embodiment, ultrafilter membranes or precision filter membranes arranged under water are used; however, it is possible to employ other filter membranes, for example, reverse osmosis membranes. The plurality of ultrafilter membranes or precision membranes are mounted to two vertically opposed pipes. A membrane filter pump 92 is connected to the membrane filter portion 91 so that the pump 92 may be driven to introduce treated water passed through the membrane filter portion 91 into the eleventh water tank 51. An outlet portion 61D of the return air lift pump 61 is connected to a topmost portion of the ninth water tank 49. Regenerated cation exchange resin 93 is introduced through this outlet portion 61D into the ninth water tank 49.

Detailed Description Text (29):
It is arranged that treated water introduced from the ninth water tank 49 into the eleventh water tank 51 is introduced by a treated water pump 98 into a primary pure water production unit 56. The treated water from the eleventh water tank 51 is subjected to ion exchange in the ion exchange resin unit 54 and is then introduced into a reverse osmosis membrane unit 55 for filtration. The treated water passed through the primary pure water production unit 56 may be recycled as primary pure water or, after being subjected to subsequent treatment by a secondary pure water production unit (not shown), as ultrapure water at the semiconductor plant.

Detailed Description Text (30):
In the water treating apparatus of the above described arrangement, acid waste water from the semiconductor plant is first introduced into the first water plant 41. At the same time, cation exchange resin 93 is introduced into the first water tank 41 through the introduction air lift pump 95. The cation exchange resin 93 is used cation exchange resin because it has been subjected to ion exchange with the treated water in the ninth water tank 49. Therefore, the cation exchange resin 93 contains calcium ions Ca.sup.++ as positive ions. The cation exchange resin 93 introduced into the first water tank 41 reacts with the acid waste water under aeration by the aeration tube 57, with the result that calcium ions of the cation exchange resin 93 are liberated (Ca-cation exchange resin+2H.sup.+ .fwdarw.Ca.sup.++ +2H-cation exchange resin). Thus, the cation exchange resin is regenerated. Liberated calcium ions react efficiently with fluoric ions in the acid waste water to form calcium fluoride.

Detailed Description Text (31):
At a semiconductor plant, high quality fluoric acid and sulfuric acid of electronics industry grade are used in washing wafers, and the wafers are then washed with ultrapure water. Acid waste water resulting from such washing operation is discharged as acid waste water from the plant. Therefore, acid waste water from

the semiconductor plant may be said to be comparatively clean waste water. Conventionally, hydrochloric acid and sulfuric acid as provided for regeneration of cation exchange resins are of industrial quality level. Therefore, acid waste water originating from fluoric acid and sulfuric acid of such quality level will function satisfactorily as chemicals for cation exchange resin regeneration.

Detailed Description Text (32):
The aeration tube 57 blows air to thoroughly agitate the acid waste water and the cation exchange resin 93 into mutual contact. Therefore, aforesaid calcium ions and fluoric ions of fluorine origin can be efficiently reacted therebetween.

Detailed Description Text (33):
Next, the water treated as described above, together with the regenerated cation exchange resin 93, flows into the neighboring second water tank 42. In the second water tank 42, at a vertically median location, the aeration tube 59 is aerating at a comparatively small rate of air blow. Within the second water tank 42, the cation exchange resin 93 precipitates because of its comparatively large specific gravity, whereas the calcium fluoride does not precipitate because of its fine particle size and reluctance to sedimentation. Therefore, the calcium fluoride is introduced into the neighboring third water tank 43 accompanying the treated water. The cation exchange resin 93 moves downward along the inclined bottom 42A so that it is automatically allowed to reach the inlet end 61A of the return air lift pump 61. Then, the cation exchange resin 93 is sucked through the inlet end 61A and moves upward together with the air blown from the aeration tube 62. While the air is discharged from the open end 61B, the regenerated cation exchange resin 93 flows into the lateral portion 61C. The cation exchange resin 93 travels along the lateral portion 61C which is slightly downward inclined and is caused to descend at the end of the lateral portion 61C. The regenerated cation exchange resin 93 is then returned to the ninth water tank 49. In this way, through its reaction with the acid waste water in the first water tank 41, the cation exchange resin 93 acts to treat the acid waste water and, simultaneously therewith, regenerate itself. Further, the regenerated cation exchange resin 93, returned to the ninth water tank 49, acts to remove positive ions of the treated water. That is, according to this second embodiment, it is possible to simultaneously carry out the steps of regenerating the cation exchange resin 93 and treating the waste water with the cation exchange resin 93. Therefore, improved efficiency of waste water treatment can be achieved. Further, by using used ion exchange resin from the ion exchange resin unit 54 of the primary pure water production system 56, the used ion exchange resin can be effectively utilized for water treating purposes, without being discarded as waste. At the same time, this arrangement contributes to waste quantity reduction, which in turn results in reduction of costs involved in disposal of wastes.

Detailed Description Text (34):
According to this second embodiment, the cation exchange resin 93 is moved between tanks by means of the air lift pumps 61 and 69; therefore, the cation exchange resin 93 is prevented from being damaged during such movement. Further, each of the air lift pumps 61 and 95 is sloped downward in the direction of movement of the cation exchange resin 93, and this insures smooth flow of the cation exchange resin 93.

Detailed Description Text (45):
Next, the water under treatment is allowed to flow from the seventh water tank 47 into the eighth water tank 48, and a supernatant liquid of the treated water therein is introduced into the next stage tank or the ninth water tank 49. The ninth water tank 49 is a cation exchange resin aeration tank to which cation exchange resin 93 regenerated by acid waste water in the first water tank 41 is continuously returned through the air lift pump 61. In this ninth water tank 49, the water is subjected to agitation and aeration by the aeration tube 88. Calcium ions contained in the treated water which are derived from calcium carbonate

mineral are removed by the action of cation exchange resin 93 on an ion exchange basis. The air blown from the aeration tube 88 not only clean the membrane filter portion 91, but facilitates replacement of calcium ions in the waste water with cation exchange resin.

Detailed Description Text (46):
The water removed of calcium ions is sucked by the pump 92 to pass through the membrane filter portion 91. The membrane filter 91 is operative to filter out cation exchange resin 93 from the water and also filter out fine suspended microorganisms and reaction products (e.g., fine calcium fluoride particles) which did not precipitate in the eighth water tank (sedimentation tank) 48. It is noted that such suspended microorganisms will become digested and die out in course of time because they were aerated in the ninth water tank 49.

Detailed Description Text (47):
In the current state of the art, ultrafilter membranes and precision filter membranes are the only types of commercial products which are available for use as submerged filters (membrane filters) to be set in a tank, and there is no other type known for use as such. In case that a reverse osmosis membrane is employed as a membrane filter, it is necessary that the reverse osmosis membrane itself be set outside the ninth water tank 49 or a cation exchange resin aeration tank, and not within the tank. At present, no reverse osmosis membrane is known which is of the submerged type for placement within the tank. One specific example of ultrafilter membrane of the submerged type for placement within the tank is "NF series" of Kubota Corporation. One specific example of precision filter membrane is "STERAPORE" of Mitsubishi Rayon Co., Ltd. Needless to say, the present invention is not limited by these specific examples. For the reverse osmosis membrane, it is only necessary that a cellulose acetate membrane of the spiral type be selected which has an operating pressure of 10-25 kg/cm.sup.2, there being no limitation whatsoever in respect of manufacturer and product type or model. Of the foregoing three types of separation membranes, reverse osmosis membrane provides highest precision of filtration. Then, ultrafilter membrane comes second and precision filter membrane comes third in filtration precision. The reverse osmosis membrane is capable of filtering ions of low molecular range, whereas either ultrafilter membrane or precision filter membrane are incapable of filtering ions of low molecular range. The ultrafilter membrane can remove all kinds of fine particles, bacteria, and virus and some of dissolved organic substances of colloidal phase. The precision filter membrane can remove some of fine particles, bacteria, and virus, and some of dissolved organic substances of colloidal phase.

Detailed Description Text (53):
The cation exchange resin 93 which has exchanged hydrogen ions with calcium ions is allowed to the next stage tank or tenth water tank 50 in which the resin 93 moves downward along the downwardly sloped bottom 50A. The cation exchange resin 93 is then sucked through the inlet end 95A of the air lift pump 95 for movement upward together with the air introduced from the aeration tube 96. Then, the cation exchange resin 93 passes through the downslope portion 95C and downward extension 95D smoothly without being damaged and is then introduced into the first water tank 41. In the first water tank 41 which functions as a cation exchange resin regenerating aeration tank, the cation exchange resin 93 is regenerated by acid waste water for repetitive use.

Detailed Description Text (54):
The treated water introduced into the eleventh water tank 51 which functions as a pump pit is pumped up by the treated water pump 98 for being introduced into the ion exchange resin unit 54 which is loaded with anion exchange resin or the like. In the ion exchange resin unit 54, the treated water is further subjected to ion exchange treatment. The treated water which has thus passed through the process of cation and anion treatment is then introduced into the reverse osmosis membrane unit 55 for treatment therein. Depending upon the final quality required of

ultrapure water, the treated water as discharged from the reverse osmosis membrane unit 55 is passed through a further series of treating units not shown for further treatment until it is finally produced into ultrapure water.

Detailed Description Text (62):
A specific example is given for further illustration. In the water treating apparatus of the second embodiment shown in FIG. 2, component units were arranged to have the following capacities respectively. The first water tank (cation exchange resin regenerating aeration tank) 41 had a capacity of about 0.6 cubic meter. The second water tank (first precipitation tank for regenerated cation exchange resin) 42 had a capacity of about 0.3 cubic meter. The third water tank (first reaction tank) 43 had a capacity of about 1.2 cubic meter. The fourth water tank (second precipitation tank) 44 had a capacity of about 0.4 cubic meter. The fifth water tank (second reaction tank) 45 had a capacity of about 1.2 cubic meter. The sixth water tank (third precipitation tank) 46 had a capacity of about 0.4 cubic meter. The first contact circulation portion 47B-1 had a capacity of about 0.6 cubic meter. The second contact circulation portion 47B-2 had a capacity of about 0.4 cubic meter. The wetting upper portion (reaction sprinkling portion) 47A had a capacity of about 0.5 cubic meter. The eighth water tank (fourth precipitation tank) 48 had a capacity of about 0.2 cubic meter. The ninth water tank (cation exchange resin aeration tank) 49 had a capacity of about 0.6 cubic meter. The tenth water tank (fifth precipitation tank) 50 had a capacity of about 0.4 cubic meter. The quantity of cation exchange resin (ion exchange resin) 93 was set at about 10% of the sum of the capacities of the first and second water tanks 41, 42 and the capacities of the ninth and tenth water tanks 49, 50. The quantity of transfer by air lift pumps 61 and 95 was set at about 3% of the throughput of waste water.

Detailed Description Text (67):
In the foregoing mode for carrying out the present invention, calcium carbonate is used in treating waste water. Alternatively, slaked lime may be used for treating the waste water. In this case, however, a coagulant is used for precipitation purposes; so any coagulant which has been ionized cannot be removed by the membrane filter and tends to adhere to the ion exchange resin. Therefore, ion exchange effect of the ion exchange resin cannot be expected.

Detailed Description Text (68):
In the foregoing second and third embodiments, cation exchange resin is used; however, for purposes of treating alkali waste water, such as ammonia water, anion exchange resin be used. In this case, the third water tank 43 through the sixth water tank 46 should be used as alkali treating tanks.

CLAIMS:

1. A water treating method comprising the steps of:

introducing alkali water or acid water into a first water tank;

introducing anionic water or cationic water into an ion exchange tank for subjecting the anionic water or cationic water to an ion exchange treatment with anion exchange resin or cation exchange resin to thereby obtain treated water;

introducing the anion exchange resin or cation exchange resin in the ion exchange tank into the first water tank to regenerate the anion exchange resin or cation exchange resin with the alkali water or acid water; and

returning the anion exchange resin or cation exchange resin regenerated in the first water tank to the ion exchange tank;

said anion exchange resin or cation exchange resin being circulated between the ion

exchange tank and the first water tank.

2. A water treating method as set forth in claim 1, wherein the alkali water or acid water introduced into the first water tank is an alkali waste water or acid waste water to be treated, and

the alkali waste water or acid waste water which has been subjected to a predetermined treatment after regenerating the anion exchange resin or cation exchange resin in the first water tank is introduced into the ion exchange tank as water to be treated.

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JPO Abstracts Database
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IBM Technical Disclosure Bulletins

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DB=JPAB; PLUR=YES; OP=ADJ			
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1. Document ID: US 6899812 B2

L9: Entry 1 of 13 File: USPT May 31, 2005

US-PAT-NO: 6899812
DOCUMENT-IDENTIFIER: US 6899812 B2

TITLE: Water filtration using immersed membranes

DATE-ISSUED: May 31, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cote; Pierre	Dundas			CA
Janson; Arnold	Burlington			CA
Husain; Hadi	Brampton			CA
Singh; Manwinder	Burlington			CA
Adams; Nicholas	Hamilton			CA

US-CL-CURRENT: 210/636; 210/321.88, 210/650

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw. D

2. Document ID: US 6863823 B2

L9: Entry 2 of 13 File: USPT Mar 8, 2005

US-PAT-NO: 6863823
DOCUMENT-IDENTIFIER: US 6863823 B2

TITLE: Inverted air box aerator and aeration method for immersed membrane

DATE-ISSUED: March 8, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cote ; Pierre	Dundas			CA

US-CL-CURRENT: 210/659; 210/257.2, 210/321.8, 210/636, 261/122.2, 261/124, 261/DIG.70

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

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3. Document ID: US 6423226 B1

L9: Entry 3 of 13 File: USPT Jul 23, 2002

US-PAT-NO: 6423226
DOCUMENT-IDENTIFIER: US 6423226 B1

TITLE: Filter package

DATE-ISSUED: July 23, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/321.86; 210/493.2, 210/636, 53/167, 53/434, 53/469

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

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4. Document ID: US 6338798 B1

L9: Entry 4 of 13 File: USPT Jan 15, 2002

US-PAT-NO: 6338798
DOCUMENT-IDENTIFIER: US 6338798 B1

TITLE: Filter package

DATE-ISSUED: January 15, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/321.86; 210/493.1, 210/636, 422/21, 53/425, 53/469

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

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5. Document ID: US 6303035 B1

L9: Entry 5 of 13 File: USPT Oct 16, 2001

US-PAT-NO: 6303035

DOCUMENT-IDENTIFIER: US 6303035 B1

TITLE: Immersed membrane filtration process

DATE-ISSUED: October 16, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cote; Pierre	Dundas			CA
Rabie; Hamid	Mississauga			CA
Pederson; Steven	Burlington			CA
Adams; Nicholas	Hamilton			CA

US-CL-CURRENT: 210/636; 134/10, 134/103.1, 134/3, 210/321.69, 210/650

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

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6. Document ID: US 6174439 B1

L9: Entry 6 of 13 File: USPT Jan 16, 2001

US-PAT-NO: 6174439
DOCUMENT-IDENTIFIER: US 6174439 B1

TITLE: Filter package

DATE-ISSUED: January 16, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/493.1; 210/636, 53/167, 53/434, 53/469, 53/79

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

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7. Document ID: US 6050278 A

L9: Entry 7 of 13 File: USPT Apr 18, 2000

US-PAT-NO: 6050278
DOCUMENT-IDENTIFIER: US 6050278 A

TITLE: Dialyzer precleaning system

DATE-ISSUED: April 18, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Arnal; Kevin R.	Chanhassen	MN		
Andrus; Robert G.	Plymouth	MN		
Luhring; David A.	Savage	MN		
Toy; Jeffrey C.	Plymouth	MN		

US-CL-CURRENT: 134/167R; 134/177, 134/186, 210/321.69, 210/636, 210/646

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

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8. Document ID: US 5928516 A

L9: Entry 8 of 13 File: USPT Jul 27, 1999

US-PAT-NO: 5928516
DOCUMENT-IDENTIFIER: US 5928516 A

TITLE: Filter package

DATE-ISSUED: July 27, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/636; 210/232, 210/257.2, 210/416.3, 422/21, 422/25, 422/26, 53/425

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

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9. Document ID: US 5403479 A

L9: Entry 9 of 13 File: USPT Apr 4, 1995

US-PAT-NO: 5403479
DOCUMENT-IDENTIFIER: US 5403479 A

TITLE: In situ cleaning system for fouled membranes

DATE-ISSUED: April 4, 1995

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Smith; Bradley M.	Hamilton			CA
Deutschmann; Ake A.	Burlington			CA
Goodboy; Kenneth P.	Wexford	PA		

US-CL-CURRENT: 210/321.69; 210/195.2, 210/257.2, 210/321.8, 210/321.89, 210/636

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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10. Document ID: US 4888116 A

L9: Entry 10 of 13 File: USPT Dec 19, 1989

US-PAT-NO: 4888116
DOCUMENT-IDENTIFIER: US 4888116 A

TITLE: Method of improving membrane properties via reaction of diazonium compounds or precursors

DATE-ISSUED: December 19, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cadotte; John E.	Minnetonka	MN		
Schmidt; Donald L.	Midland	MI		

US-CL-CURRENT: 210/636; 210/500.38, 210/654, 210/655

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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☐ 1. Document ID: US 6899812 B2

L9: Entry 1 of 13 File: USPT May 31, 2005

US-PAT-NO: 6899812
DOCUMENT-IDENTIFIER: US 6899812 B2

TITLE: Water filtration using immersed membranes

DATE-ISSUED: May 31, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cote; Pierre	Dundas			CA
Janson; Arnold	Burlington			CA
Husain; Hadi	Brampton			CA
Singh; Manwinder	Burlington			CA
Adams; Nicholas	Hamilton			CA

US-CL-CURRENT: 210/636; 210/321.88, 210/650

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw. De

☐ 2. Document ID: US 6863823 B2

L9: Entry 2 of 13 File: USPT Mar 8, 2005

US-PAT-NO: 6863823
DOCUMENT-IDENTIFIER: US 6863823 B2

TITLE: Inverted air box aerator and aeration method for immersed membrane

DATE-ISSUED: March 8, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cote ; Pierre	Dundas			CA

US-CL-CURRENT: 210/659; 210/257.2, 210/321.8, 210/636, 261/122.2, 261/124, 261/DIG.70

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw. D

3. Document ID: US 6423226 B1

L9: Entry 3 of 13 File: USPT Jul 23, 2002

US-PAT-NO: 6423226
DOCUMENT-IDENTIFIER: US 6423226 B1

TITLE: Filter package

DATE-ISSUED: July 23, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/321.86; 210/493.2, 210/636, 53/167, 53/434, 53/469

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw. D

4. Document ID: US 6338798 B1

L9: Entry 4 of 13 File: USPT Jan 15, 2002

US-PAT-NO: 6338798
DOCUMENT-IDENTIFIER: US 6338798 B1

TITLE: Filter package

DATE-ISSUED: January 15, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/321.86; 210/493.1, 210/636, 422/21, 53/425, 53/469

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw. D

5. Document ID: US 6303035 B1

L9: Entry 5 of 13 File: USPT Oct 16, 2001

US-PAT-NO: 6303035

DOCUMENT-IDENTIFIER: US 6303035 B1

TITLE: Immersed membrane filtration process

DATE-ISSUED: October 16, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cote; Pierre	Dundas			CA
Rabie; Hamid	Mississauga			CA
Pederson; Steven	Burlington			CA
Adams; Nicholas	Hamilton			CA

US-CL-CURRENT: 210/636; 134/10, 134/103.1, 134/3, 210/321.69, 210/650

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

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6. Document ID: US 6174439 B1

L9: Entry 6 of 13 File: USPT Jan 16, 2001

US-PAT-NO: 6174439
DOCUMENT-IDENTIFIER: US 6174439 B1

TITLE: Filter package

DATE-ISSUED: January 16, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/493.1; 210/636, 53/167, 53/434, 53/469, 53/79

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

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7. Document ID: US 6050278 A

L9: Entry 7 of 13 File: USPT Apr 18, 2000

US-PAT-NO: 6050278
DOCUMENT-IDENTIFIER: US 6050278 A

TITLE: Dialyzer precleaning system

DATE-ISSUED: April 18, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Arnal; Kevin R.	Chanhassen	MN		
Andrus; Robert G.	Plymouth	MN		
Luhring; David A.	Savage	MN		
Toy; Jeffrey C.	Plymouth	MN		

US-CL-CURRENT: 134/167R; 134/177, 134/186, 210/321.69, 210/636, 210/646

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

8. Document ID: US 5928516 A

L9: Entry 8 of 13 File: USPT Jul 27, 1999

US-PAT-NO: 5928516
DOCUMENT-IDENTIFIER: US 5928516 A

TITLE: Filter package

DATE-ISSUED: July 27, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/636; 210/232, 210/257.2, 210/416.3, 422/21, 422/25, 422/26, 53/425

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

9. Document ID: US 5403479 A

L9: Entry 9 of 13 File: USPT Apr 4, 1995

US-PAT-NO: 5403479
DOCUMENT-IDENTIFIER: US 5403479 A

TITLE: In situ cleaning system for fouled membranes

DATE-ISSUED: April 4, 1995

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Smith; Bradley M.	Hamilton			CA
Deutschmann; Ake A.	Burlington			CA
Goodboy; Kenneth P.	Wexford	PA		

US-CL-CURRENT: 210/321.69; 210/195.2, 210/257.2, 210/321.8, 210/321.89, 210/636

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

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10. Document ID: US 4888116 A

L9: Entry 10 of 13 File: USPT Dec 19, 1989

US-PAT-NO: 4888116
DOCUMENT-IDENTIFIER: US 4888116 A

TITLE: Method of improving membrane properties via reaction of diazonium compounds or precursors

DATE-ISSUED: December 19, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cadotte; John E.	Minnetonka	MN		
Schmidt; Donald L.	Midland	MI		

US-CL-CURRENT: 210/636; 210/500.38, 210/654, 210/655

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

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1. Document ID: US 6899812 B2

L9: Entry 1 of 13 File: USPT May 31, 2005

US-PAT-NO: 6899812
DOCUMENT-IDENTIFIER: US 6899812 B2

TITLE: Water filtration using immersed membranes

DATE-ISSUED: May 31, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cote; Pierre	Dundas			CA
Janson; Arnold	Burlington			CA
Husain; Hadi	Brampton			CA
Singh; Manwinder	Burlington			CA
Adams; Nicholas	Hamilton			CA

US-CL-CURRENT: 210/636; 210/321.88, 210/650

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

2. Document ID: US 6863823 B2

L9: Entry 2 of 13 File: USPT Mar 8, 2005

US-PAT-NO: 6863823
DOCUMENT-IDENTIFIER: US 6863823 B2

TITLE: Inverted air box aerator and aeration method for immersed membrane

DATE-ISSUED: March 8, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cote ; Pierre	Dundas			CA

US-CL-CURRENT: 210/659; 210/257.2, 210/321.8, 210/636, 261/122.2, 261/124, 261/DIG.70

Full | Title | Citation | Front | Review | Classification | Date | Reference | | Claims | KWIC | Draw D

☐ 3. Document ID: US 6423226 B1

L9: Entry 3 of 13 File: USPT Jul 23, 2002

US-PAT-NO: 6423226
DOCUMENT-IDENTIFIER: US 6423226 B1

TITLE: Filter package

DATE-ISSUED: July 23, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/321.86; 210/493.2, 210/636, 53/167, 53/434, 53/469

Full | Title | Citation | Front | Review | Classification | Date | Reference | | Claims | KWIC | Draw D

☐ 4. Document ID: US 6338798 B1

L9: Entry 4 of 13 File: USPT Jan 15, 2002

US-PAT-NO: 6338798
DOCUMENT-IDENTIFIER: US 6338798 B1

TITLE: Filter package

DATE-ISSUED: January 15, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/321.86; 210/493.1, 210/636, 422/21, 53/425, 53/469

Full | Title | Citation | Front | Review | Classification | Date | Reference | | Claims | KWIC | Draw D

☐ 5. Document ID: US 6303035 B1

L9: Entry 5 of 13 File: USPT Oct 16, 2001

US-PAT-NO: 6303035

DOCUMENT-IDENTIFIER: US 6303035 B1

TITLE: Immersed membrane filtration process

DATE-ISSUED: October 16, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cote; Pierre	Dundas			CA
Rabie; Hamid	Mississauga			CA
Pederson; Steven	Burlington			CA
Adams; Nicholas	Hamilton			CA

US-CL-CURRENT: 210/636; 134/10, 134/103.1, 134/3, 210/321.69, 210/650

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw De

6. Document ID: US 6174439 B1

L9: Entry 6 of 13 File: USPT Jan 16, 2001

US-PAT-NO: 6174439
DOCUMENT-IDENTIFIER: US 6174439 B1

TITLE: Filter package

DATE-ISSUED: January 16, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/493.1; 210/636, 53/167, 53/434, 53/469, 53/79

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw De

7. Document ID: US 6050278 A

L9: Entry 7 of 13 File: USPT Apr 18, 2000

US-PAT-NO: 6050278
DOCUMENT-IDENTIFIER: US 6050278 A

TITLE: Dialyzer precleaning system

DATE-ISSUED: April 18, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Arnal; Kevin R.	Chanhassen	MN		
Andrus; Robert G.	Plymouth	MN		
Luhring; David A.	Savage	MN		
Toy; Jeffrey C.	Plymouth	MN		

US-CL-CURRENT: 134/167R; 134/177, 134/186, 210/321.69, 210/636, 210/646

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

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8. Document ID: US 5928516 A

L9: Entry 8 of 13 File: USPT Jul 27, 1999

US-PAT-NO: 5928516
DOCUMENT-IDENTIFIER: US 5928516 A

TITLE: Filter package

DATE-ISSUED: July 27, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/636; 210/232, 210/257.2, 210/416.3, 422/21, 422/25, 422/26, 53/425

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

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9. Document ID: US 5403479 A

L9: Entry 9 of 13 File: USPT Apr 4, 1995

US-PAT-NO: 5403479
DOCUMENT-IDENTIFIER: US 5403479 A

TITLE: In situ cleaning system for fouled membranes

DATE-ISSUED: April 4, 1995

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Smith; Bradley M.	Hamilton			CA
Deutschmann; Ake A.	Burlington			CA
Goodboy; Kenneth P.	Wexford	PA		

US-CL-CURRENT: 210/321.69; 210/195.2, 210/257.2, 210/321.8, 210/321.89, 210/636

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

10. Document ID: US 4888116 A

L9: Entry 10 of 13 File: USPT Dec 19, 1989

US-PAT-NO: 4888116
DOCUMENT-IDENTIFIER: US 4888116 A

TITLE: Method of improving membrane properties via reaction of diazonium compounds or precursors

DATE-ISSUED: December 19, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cadotte; John E.	Minnetonka	MN		
Schmidt; Donald L.	Midland	MI		

US-CL-CURRENT: 210/636; 210/500.38, 210/654, 210/655

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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☐ 1. Document ID: US 6899812 B2

L9: Entry 1 of 13 File: USPT May 31, 2005

US-PAT-NO: 6899812
DOCUMENT-IDENTIFIER: US 6899812 B2

TITLE: Water filtration using immersed membranes

DATE-ISSUED: May 31, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cote; Pierre	Dundas			CA
Janson; Arnold	Burlington			CA
Husain; Hadi	Brampton			CA
Singh; Manwinder	Burlington			CA
Adams; Nicholas	Hamilton			CA

US-CL-CURRENT: 210/636; 210/321.88, 210/650

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

☐ 2. Document ID: US 6863823 B2

L9: Entry 2 of 13 File: USPT Mar 8, 2005

US-PAT-NO: 6863823
DOCUMENT-IDENTIFIER: US 6863823 B2

TITLE: Inverted air box aerator and aeration method for immersed membrane

DATE-ISSUED: March 8, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cote ; Pierre	Dundas			CA

US-CL-CURRENT: 210/659; 210/257.2, 210/321.8, 210/636, 261/122.2, 261/124, 261/DIG.70

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw D

3. Document ID: US 6423226 B1

L9: Entry 3 of 13 File: USPT Jul 23, 2002

US-PAT-NO: 6423226
DOCUMENT-IDENTIFIER: US 6423226 B1

TITLE: Filter package

DATE-ISSUED: July 23, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/321.86; 210/493.2, 210/636, 53/167, 53/434, 53/469

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw D

4. Document ID: US 6338798 B1

L9: Entry 4 of 13 File: USPT Jan 15, 2002

US-PAT-NO: 6338798
DOCUMENT-IDENTIFIER: US 6338798 B1

TITLE: Filter package

DATE-ISSUED: January 15, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/321.86; 210/493.1, 210/636, 422/21, 53/425, 53/469

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw D

5. Document ID: US 6303035 B1

L9: Entry 5 of 13 File: USPT Oct 16, 2001

US-PAT-NO: 6303035

DOCUMENT-IDENTIFIER: US 6303035 B1

TITLE: Immersed membrane filtration process

DATE-ISSUED: October 16, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cote; Pierre	Dundas			CA
Rabie; Hamid	Mississauga			CA
Pederson; Steven	Burlington			CA
Adams; Nicholas	Hamilton			CA

US-CL-CURRENT: 210/636; 134/10, 134/103.1, 134/3, 210/321.69, 210/650

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

6. Document ID: US 6174439 B1

L9: Entry 6 of 13 File: USPT Jan 16, 2001

US-PAT-NO: 6174439
DOCUMENT-IDENTIFIER: US 6174439 B1

TITLE: Filter package

DATE-ISSUED: January 16, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hopkins; Scott D.	Dryden	NY		
Spencer; Daniel W.	Cortland	NY		
Peri; Joseph A.	DeRuyter	NY		

US-CL-CURRENT: 210/493.1; 210/636, 53/167, 53/434, 53/469, 53/79

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

7. Document ID: US 6050278 A

L9: Entry 7 of 13 File: USPT Apr 18, 2000

US-PAT-NO: 6050278
DOCUMENT-IDENTIFIER: US 6050278 A

TITLE: Dialyzer precleaning system

DATE-ISSUED: April 18, 2000

INVENTOR-INFORMATION: